Ar-CHI-tecture: Architecture and Interaction

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Abstract
The rise of ubiquitous computing leads to a natural convergence between the areas of architectural design (the design of buildings, spaces and experience of being in and moving through them) and HCI. We suggest that Architecture and CHI have much to learn from each other in terms of research and practice. This workshop will bring together these communities to explore the benefits of architecture envisioned as integral to an expanded CHI community. The workshop organizers aim to create a framework for future collaboration and identify new directions for research in this multidisciplinary field. This promises significant impacts on both interaction research and its real-world applications.

Keywords
Architecture; interaction; ubiquitous computing

ACM Classification Keywords
H.5.2 [Information Interfaces And Presentation]: User Interfaces - Interaction styles;

General Terms
Design, Experimentation, Human Factors, Theory

Introduction

The vision of pervasive or ubiquitous computing [12] introduced the idea that the environment is fundamental to the interaction process. We have seen many computing projects engaged in building physical spaces, including the development of 'smart homes' in both the academic and commercial sectors [3]. The use of ambient displays [13] and physical interfaces have led to the notion of the building and physical artifacts becoming an integral part of ubiquitous technologies. Ishii and Ulmer [8] envisioned the transformation of architectural surfaces into active interfaces, fusing the physical and digital realm. In mobile computing the role of the (typically urban) environment and spatial context is beginning to be factored into the design of interactions [4]. There is increasing evidence that the environmental context of such interactions cannot be considered merely a neutral container for those actions or behaviors.

Equally architects have been interested in the architectural opportunities of digitally enhanced spaces [9, 10]. Architectural and Computing pioneer John Frazer pre-empted many developments in tangible interaction and digital inhabitation back in the early 1990s [7], yet his developments are unknown to many in ubiquitous computing research. More recently a number of architects have actively integrated interactive digital technologies into the fabric of new designs. For example, Architects at ART+COM have designed a museum for BMW using complex projections and ambient displays; Hyposurface by Mark Goulthorpe, Blur Building by Diller Scofidio & Renfro, and Bubbles by Michael Fox, Kas Oosterhuis and Ilona Lénárd have used digital projectors to create complex adaptive spaces. In the field of architectural education, postgraduate courses[1,2] are currently being offered to explore the opportunities that digital interaction offers to the architectural design community. Others such as Neil Spiller [12] are actively promoting the use of digital technologies as a fundamental aspect of the future built environment. Yet this work has been done largely without engaging with similar research developments in the HCI community. Ingram in his article *Learning from Architecture* [5] highlights that HCI can also learn from the deep historical precedence that architecture brings to the table. He also suggests that interaction design is very similar to the profession of architecture in the manner in which it melds art and engineering along with its deep impact on the cultural landscape. This immediately leads to questions about how we, as interaction experts, can both expand our understanding, approaches and methodologies using architectural insights.

This gap is important to both communities. For example CHI 2012 is promoting themes that include digital arts and sustainability, currently 22% of energy consumed in the US is in the home [2], mostly for heating and cooling. Many HCI based interventions on sustainability issues come from systems aimed at reducing a building's energy consumption, for example the Adaptive Living Interface system[1], but how much do interaction experts understand buildings?

When technologies, are pervasively embedded in the physical fabric of everyday environments, how will architects adapt to the visual challenges of ambient displays [5] and the network of sensor systems? Will

[1] http://bit.ly/gZ56sa

[2] http://www.iaac.net/

our buildings need to adapt to encompass new kinds of spatial needs (such as informal conversation spaces to allow mobile phone users to talk in private [6])? If ubiquitous computing technology becomes as pervasive as expected will architects become as much a part of the CHI community as visual or graphics designers did with the advent of the graphical display? Will the architecture profession generate new sub-specialisms in the way that interaction-designers have spun-off from the design profession? Architecture also brings to HCI a long legacy of approaching problems from a design-led perspective by interacting with clients to design complex, multi-million dollar systems (buildings). Can HCI learn from any of these mature design practices?

Beyond the question of digital devices inside / as part of buildings, there is another relevant connection between the field of human computer interaction and architectural design. Ultimately, human-computer interaction is a type of human-artifact interaction, and its research is characterized by analysing situated human behavior, cognitive processes and task structures. Buildings can also be understood as artifacts, and humans interact with these artifacts in numerous ways. In psychology, this has been investigated under the label "environmental psychology" since the 1970s. We believe that the methodological toolbox of HCI researchers and practitioners can be valuable for understanding the challenges of designing buildings that meet user needs.

Despite the potential for a rich overlap of perspectives, as outlined above, there is, as yet, no direct conduit between the architectural and the human computer interaction communities to exchange new developments or knowledge from either practice. We propose that a workshop could help to identify the paradigms, skill sets and experiences of each domain, leading to new areas of research in architecture and HCI. While not precluding the kinds of themes and issues that might arise from the workshop, potential issues are:

- The meaning of space in architectural design
- The role of space in building cognition
- Empirical architectural research methods and techniques
- Architectural theories relevant to ubiquitous computing research
- Navigation and wayfinding in architecture and interaction design
- The notion and role of user in architecture and interaction design
- The design of large-scale virtual spaces
- Techniques and approaches to building usability

Goals of the Workshop

- To bring together a community of researchers and designers who are creating interactive technologies in architectural settings
- To present and discuss design and research projects with a theoretical foundation in architecture
- To share and discuss concepts and prototypes that have been designed to explore ubiquitous computing in empirical work

- To identify fundamental differences, similarities and synergies between different design and research approaches that use architecture differently in HCI

The workshop hopes to create a roadmap for future research and collaboration through presentation at the "spotlight on workshops" poster session and may lead to a special addition of a journal if work is appropriate.

Timeliness and importance of the theme

A number of threads are coming together to make architecture an important and timely issue. New technology permits architects to independently experiment with digital technologies, but the technology alone leaves them unaware of the wealth of knowledge possessed by the interaction design community. Pervasive technologies such as ambient information displays are emerging as an important research focus in many environments. Interaction design research is increasingly becoming aware of the need to move from 'stuff' to understanding 'space' [11]. This creates the problem of understanding the impact of the built environment on the interaction process. Architecture research has developed a number of techniques to describe the built environment that may be of benefit to the interaction design community

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